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ABSTRACT

Reflective teaching has been the basic principle underlying the teacher education program at the Stichting Opleiding Leraren, a teacher's college in Utrecht, The Netherlands. It has been questioned, however, whether reflective teaching is equally suitable for every student. A longitudinal follow-up study was started in which the central research question was: How do individual students develop during their preparation program? In the first part of the research, phase 1a and 1b, the goal is description. Phase 1a develops a framework of analysis that describes differences in beliefs about learning among prospective teachers. Phase 1b's subquestions are: (1) How do students with different beliefs about learning develop during the teacher education program? and (2) What is the effect of the training on the development of these different kinds of students? This paper describes the research method and results of phase 1a and the results of phase 1b. The analysis framework that has been developed to differentiate among learning orientations is presented, and the effects of the program on different students are discussed. (JD)

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SUPPLY AND DEMAND; TOWARDS DIFFERENTIATION IN TEACHER EDUCATION, BASED ON DIFFERENCES IN LEARNING ORIENTATIONS

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SUPPLY AND DEMAND: TOWARDS DIFFERENTIATION IN TEACHER EDUCATION, BASED ON DIFFERENCES IN LEARNING ORIENTATIONS

Introduction and problem definition

For more than ten years reflective teaching has been the basic principle underlying the teacher education program of the Department of Mathematics of the Stichting Opleiding Leraren (SOL), a teachers' college in Utrecht, the Netherlands. This department is responsible for the education of mathematics teachers for secondary schools. The training takes $4^1/2$ years and is comprised of one principal subject (e.g. mathematics) and one subsidiary subject (e.g. physics), plus one year of professional preparation. This preparation component is spread over the entire period of $4^1/2$ years.

Korthagen (1985) has described the content and the theoretical foundation of the program. One of its main characteristics is that the promotion of reflective thinking is a fundamental learning goal *before* the field-based experiences in the second year. For example, relationships with fellow students and the learning processes during mathematics courses are used as objects of reflection. Korthagen has also given the results of an evaluative study. One of the important results was that over 50% of the former students reported positive effects of reflective teaching. There was some doubt, however, whether training in which reflective teaching is a basic principle, is equally suitable for every student. Therefore a longitudinal follow-up study was started, in which the central research question is: *how do individual students develop during their preparation program?*

In the first phase of the research the goal is description. This phase has consisted of phase 1a, in which a framework of analysis has been developed that describes differences in beliefs about learning among prospective teachers, and phase 1b in which the subquestions are:

a. *How do students with different beliefs about learning develop during the teacher education program?*
b. *What is the effect of the training on the development of these different kind of students?*

In a second phase of the research there will be more emphasis on prescription (construction of a differentiated program for teacher education on the basis of the results of phase 1). The ultimate goal of this research is consequently the adjustment of teacher education to the differences among individual students.

Here the research method and the results of phase 1a are described, together with the initial results of phase 1b. This means that the analysis framework that has been developed to differentiate among learning orientations is presented and the effects of the program on different students are discussed.

The side of the teacher educators is also extensively discussed: what do they want to achieve and how do they react in practice to various types of students?

Theoretical framework

The notion of reflection is based on cybernetic models from cognitive psychology, e.g. on the model of Miller, Galanter and Pribram (1960). They distinguish levels in thinking and put reflection at the so-called *meta-cognitive* level. Flavell (1976, p.232) defines this notion as follows: "metacognition refers to one's knowledge concerning one's own cognitive processes and products or anything related to them, e.g. the learning-relevant properties of information or data." Skemp (1979) refers to a *delta-one* level that bears on the internal organization of the interaction between the individual and his environment and a *delta-two* level that sees to the improvement of the delta-one schemata. We find the same bipartition with Piaget (1977), who distinguishes between the *abstraction empirique* and the *abstraction réfléchissante*.

Kolb (cf. Kolb & Fry, 1975) introduced a cyclic model for reflection. Korthagen (1985) presented a similar model, called the ALACT-model, consisting of four phases: (1) action, (2) looking back on the action, (3) awareness of

essential aspects, (4) creating alternative methods of action. Characteristic of such such phase models for reflection is a phase of generalization or structuralization (Piaget, 1977, speaks of a *reorganization*).

The following definition is the result of an analysis of the notion of reflection in literature: *A person reflects when he is looking back on his experiences and/or knowledge and is engaged in establishing for himself a new structure or in assessing those experiences and/or knowledge.* This definition also covers the analysis of affective aspects in one's own functioning, which is very important for teacher education and to which, in our opinion, far too little attention has been paid in the literature.

Little is known about differences in the way in which prospective teachers develop. Korchagen (1985) has pointed out that already at the beginning of their training, student teachers differ in the degree to which they prefer to learn via *internal direction* (reflection) or via *external direction* (e.g. by a supervisor). We speak of *learning orientations*. Differences in learning orientation may be caused by the *belief systems* and *subjective theories* students have about learning. The so-called Göteborg group showed that people can differ considerably with regard to their *conceptions of learning* (cf. Säljö, 1979). For the origin of an internal orientation it is important to what extent the person believes that the relationship between one's own behavior and the consequences of it is determined by factors within that person himself. People who believe this have a so-called *internal locus of control*. Rotter (1966, p.2) defines this locus of control as "a generalized attitude, belief or expectancy regarding the nature of the causal relationship between one's own behavior and its consequences."

In phase 1 of our research we tried to determine the learning orientations of prospective teachers. This has led to the conclusion that it is not possible to classify students according to the degree of preference for reflection without taking into account the areas (perspectives) on which learning has a bearing. Sometimes students appear to have an internal orientation in one area and an external orientation in another. In a pilot-study we found the following areas that learning can have a bearing on (table 1):

Perspectives of students in the initial stage of the teacher education program	1.the prospective teacher him(her)self 2.the fellow students 3.the subject matter (mathematics) taught by the teachers' college.
Perspectives of students with field experiences	1.the prospective teacher him(her)self 2.the students in the schools 3.the subject-matter (mathematics) at school 4.the school

table 1

Method

In the research study we examine 18 prospective mathematics teachers during their training at the SOL (based on reflective teaching). We use the following research model (figure 1):

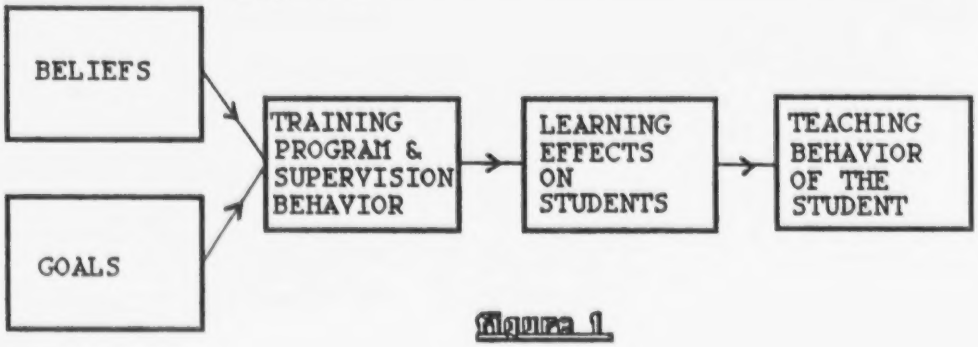

figure 1

The process variables are the beliefs (and explicit goals) and the supervision behavior of teacher educators, while the product variable consists of the learning effects on students.

Table 2 shows with which instruments and methods of analysis these variables are measured.

Variables	Instrument	Method of analysis and processing
BELIEFS (and explicit goals) of teacher educators	1. Standardized interviews	1. Selection of statements referring to beliefs, explicit goals and subjective theories of teacher educators
	2. Questionnaires	2. Quantitative analysis of scores on five-point-Likert-type items
	3. Kelly's repertory grid	3. Determination of constructs and perceptions of qualities of students
SUPERVISION BEHAVIOR OF THE TEACHER EDUCATORS (recorded on video)	4. Blumberg's observation system (Blumberg, 1970)	4. Determination of the ratio process-oriented and product-oriented supervision
	5. Observation instrument based on the ALACT-model (Korthagen, 1985)	5. Determination of phases in supervision sessions
LEARNING EFFECTS ON STUDENTS		
a) at the delta-one level (cognitions)	6. Learner reports	6. Qualitative analysis of open questions with the aid of a system of categories (Korthagen, 1982) and quantitative analysis of five-point-Likert-type items
b) at the delta-two level (learning orientation)	7. I.E.O.-test	7. Standard processing with the aid of SPSS
	8. Journals of student teachers	8. Analysis based on the ALACT-model
c) at both levels	9. Standardized interviews with students	9. Categorization of statements and learning conceptions

table 2

Because the group of examined students started their training in August, 1984, it will be some time before all the results are available. We restrict ourselves to a discussion of those research methods and instruments that have already yielded reportable data, i.e. numbers 1,2,3,7 and 9.

In the interviews with the teacher educators (1) we tried to find out what their goals are, how they try to implement these in the program and what they themselves believed to be the results. The analysis of these interviews was not only directed at establishing goals that are explicitly formulated, but also at tracing half-conscious or non-conscious beliefs and subjective theories. This primarily qualitative analysis has led to a questionnaire (2) in which a number of statements about the fundamentals of teacher education had to be scored on a scale from one to five.

Kelly's repertory grid (Kelly, 1955) (3) enabled us to make the categories explicit that are used by the teacher educators when assessing their students. Kelly speaks of *constructs*. Examples of such constructs are dependent-

independent, certain-uncertain, etc. In this RepGrid-method the teacher educator gets three cards with the names of three students. He is invited to mention one quality (construct) in which one of the students differs from the other two. Finally the teacher has to indicate a score between 1 and 5 for all the constructs mentioned by him and for all the students in the group that was examined.

In order to determine how reflective students are with regard to the various areas that were distinguished in table 1, two questionnaires were developed which measure to what degree students have an internal or an external learning orientation with regard to those perspectives (the I.E.O.-test) (7). One questionnaire is designed for students in the initial stage of their training, while the second is for students who have participated in field experiences. (For the SOL Mathematics Department this means third and fourth year students; cf. Korthagen, 1985.) Here we restrict ourselves to the version for the students in the initial stage of the training, because the data obtained by that I.E.O.-test are relevant to the students examined. This I.E.O.-test consists of three groups of items, corresponding with the perspectives "the prospective teacher him(her)self" (S), "the fellow students" (F) and "the subject matter (mathematics) taught by the teachers' college" (M). For each area there is a subscale measuring to what extent students have an internal learning orientation (I) in this area and a subscale measuring to what extent they are externally oriented (E). So there are 6 subscales (SI, SE, FI, FE, MI, ME), each consisting of two types of items. The one type asks the students to rate themselves on a five-point scale according to the extent to which a certain statement is applicable to their way of learning. On the other type they have to indicate how frequently they do something. An example of the latter type of item is: I reflect on the question "who am I".

After a tryout involving 57 prospective mathematics teachers, we developed the final version of the I.E.O.-test (61 items). This was administered to 138 first and second year students from three teachers' colleges.

The students in our study were interviewed twice a year (9). The first interviews took place in the first few weeks of their study. Among other things the students were then asked why they had chosen this training and what their first impressions of the training were. In the interviews held after that and in the ones that are to follow, the most important points are: the appreciation of the training, the learning results, points of criticism, the characteristics of the training as seen by the student, the learning conceptions of the student and especially the student's attitude towards reflective teaching.

Results

In the *interviews with the teacher educators* reflective teaching appeared to be an explicit goal, but concrete contents of knowledge, which in their opinion should be acquired by the students, were also mentioned, such as knowledge about the process of mathematics learning, certain didactic principles and knowledge in the field of interaction between people (listening, cooperation, etcetera). In the second year of study the accent shifted more towards requirements with respect to skills in these fields.

The *questionnaire for the teachers* showed a homogeneous "team view". We give the scores of those statements that yielded the highest mean score on the five-point-scale (Table 3). A score of 1 means "the statement does not apply to me at all", a score of 5 means "this statement is wholly applicable to me).

These results, as well as the scores of other statements, support the conclusion that the model for teacher education that was published earlier (Korthagen, 1985), is still endorsed by the individual staff members.

The *RepGrid*, however, showed that the teacher educators in their view of individual students had entirely different constructs in their minds than reflective/nonreflective (mentioned by only one teacher educator in the RepGrid). Many constructs had a bearing on qualities that could also have been mentioned as characteristic for one's personal functioning outside the college,

Statements about the fundamentals of teacher education	Scores (n=13)						
	1	2	3	4	5	mean	st.dev
I think that students should be able to feel secure with me	-	-	1	3	9	4.6	0.7
I think that students should be offered structure	-	-	-	7	6	4.5	0.5
I think that students should be challenged	-	-	-	7	6	4.5	0.5
I think that students should learn to reflect on their actions	-	-	-	8	5	4.4	0.5
I think that prospective teachers should develop a reflective attitude	-	-	-	9	4	4.3	0.5
I think that students should learn to reflect on their own functioning	-	-	1	7	4	4.3	0.6

table 3

such as shy, spontaneous, cheerful. The most frequently mentioned were: reserved (6x), rich in initiative (5x) and industrious (4x).

Probing about the relationship between qualities of the student and the strategies followed by the teacher educators to reach the training goals, resulted in the discovery that these goals were often abandoned or that it was simply unknown to the educators how they could work towards the goals with certain students.

It was also indicated that quite often one had to moderate one's educational claims, because otherwise it was expected that the resistance would become so great that the student concerned would not learn anything at all. This spontaneous differentiation in strategies appeared to be based on all sorts of beliefs and implicit theories. There were no explicit theories about differences in learning orientations, certainly not at the level of the entire team of teacher educators. On account of the interviews we arrived at the hypothesis that teacher educators only understand the way of learning of reflective students (e.g. because they themselves have a reflective style). This was investigated (in two consecutive years) by asking two of the educators who had been giving an intensive educational course in a second-year group, to complete two questionnaires with statements about the way of learning. One questionnaire had to be completed in the way the teacher educator thought that the student, indicated by him as being "most reflective", would have done, the other questionnaire in the way the student indicated by the teacher educator as being "least reflective", would have done. Next the p.m. correlation was calculated between the predicted scores and the real scores (on a five-point-scale), for 34 statements. The results are shown in table 4.

p.m.corr. between predicted and real scores	teach.ed.A (1984)	teach.ed.B (1984)	teach.ed. (1985)	teach.ed.A (1985)
most reflective student	0.73	0.53	0.78	0.66
least reflective student	-0.16	-0.13	-0.24	0.04

table 4

In a t-test carried out on the differences between the scores predicted by the teacher educators and the real scores, the predictions for reflective students appeared to be significantly better ($p=0.0005$, one-tailed). As the variance of the discrepancy scores differed for the two groups of students, a t-test is less reliable. That is why we also used a nonparametric test (Wilcoxon). This also resulted in a significant difference ($p=0.0015$). Consequently the data support the hypothesis that the teacher educators only understand the way of learning of reflective students.

As to the results from the *I.E.O.-test*, we first give the data concerning the

reliability of the test, based on the completion by 138 first and second year mathematics students from different colleges (63 SOL-students and 75 from two other colleges), and after that the results of the special group of students from our research project.

It appears from table 5 that the internal consistency of the subscales was quite good. (A separate publication will be devoted to this test.)

n = 138	scales SI	SE	FI	FE	MI	ME
number of items	11	10	10	10	10	10
Cronbach's alpha	.87	.77	.87	.81	.85	.80

table 5

For each of the scales SI, FI and MI a comparison was made between the scores of first and second year students. No significant differences were found in the FI and MI scales, but in the SI scale (reflection on oneself) second year SOL students proved to score significantly higher than first year students ($p<0.05$, two-tailed). This difference between the first and the second year was not significant with students from the other colleges.

A second interesting result was obtained by comparing the 8 students from the experimental group who gave up their study after the first year with the 10 students who continued their study. From the 8 students who gave up, three of them did so at such an early stage, that the I.E.O.-test could not be given to them. The remaining students (5 drop-outs and the 10 who stayed on) completed the test in their first year. There were no significant differences for each separate scale, but the sum total of the scores in the SI, FI and MI scales (the internal scales together) was definitely lower for those who gave up their study ($p=.07$, in a one-tailed t-test).

Within the scope of this article it is impossible to mention all the qualitative results from the *student interviews*. We restrict ourselves to a discussion of the characteristics of the group of 8 drop-outs versus the group of 10 students who stayed on and of the differences in learning conceptions.

The drop-outs can be divided into:

a. students who came for the mathematics rather than for the teaching profession and who were disappointed in that (too much didactics and education).
b. students who were (proved to be) weak in mathematics.
c. students who had mathematics as a second choice.
d. students showing a combination of these factors.

Among those students who stayed on, we see people who are enthusiastic about practically everything the training has to offer, students who are moderately enthusiastic and students who are critical, but who continue in spite of that. Critical remarks about the teacher educators are sometimes swallowed; the students "play the game".

In the student interviews we have found a number of differences among students with respect to their preferences and beliefs as to learning. These differences have given rise to a descriptive model (figure 2), which was also developed on the basis of publications of Cantor (1972), Elliot (1976) and Maslow (1970). In this model the bases of the triangles indicate that we are dealing with continua.

In the model a first fundamental difference among students is the degree to which they are *growth-motivated* (Maslow, 1970), i.e. in how far they see the teacher education program as a means to growth and self-realization. Other differences among students are the degree to which they want supervision (cf. Elliot, 1976) and the degree to which they themselves indicate what they expect from the supervision. With those students who are able to do the latter (we are talking about growth-motivated, independent students) the classical distinction *process-oriented/product-oriented* is applicable. We are now developing instruments to quantify individual developments in students with regard to

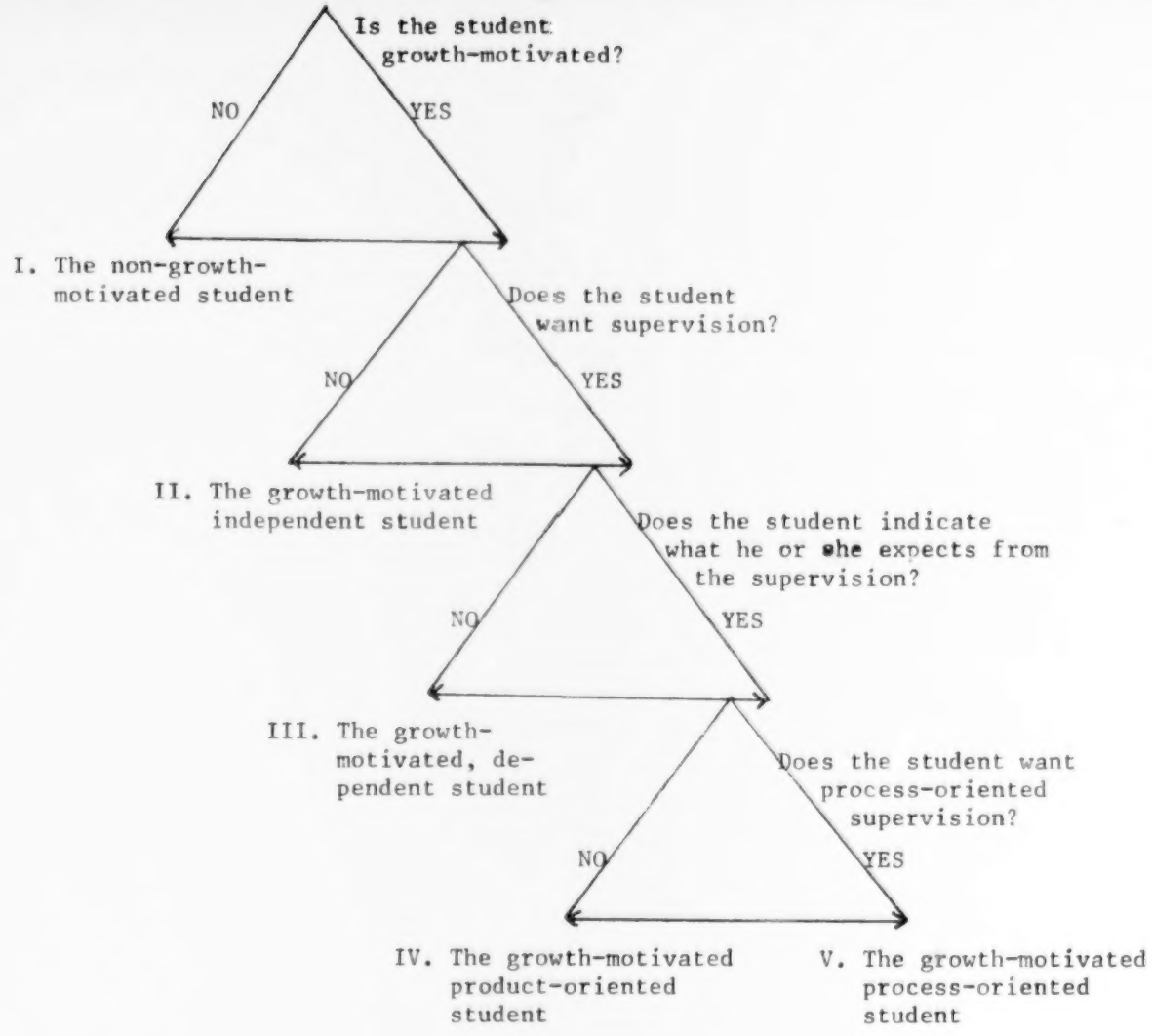

figure 2

these aspects.

From the interviews with the teacher educators and from the RepGrid it appears that the educators have a strong preference for the growth-motivated, process-oriented type. Besides, as was stated, the team of educators has a rather unanimous vision of the training program. That is why students feel a strong pressure to learn in a certain way. Some students experience that way of learning as alien to what they are used to and/or regard this as useless. The most important points of criticism of the drop-outs and of some who stay on (recorded in the second half of the first year of study) may in fact be interpreted as a clash of belief systems, or more specifically, as a clash of underlying learning conceptions:

- there is too much one has to find out for oneself.
- it should be clearer what one has to learn, when something should be finished, what is right and what is not.
- those teachers keep on asking questions.
- you have to say again and again what your opinion is, what you were thinking or feeling.
- there is little room to do it your own way
- education classes are 'supersocial'.
- it is not genuine, too much coercion.

- one *has* to participate *and* think it's fun doing it.
- too much must come from the group, too little is explained.
- there is no structure.

It is remarkable that those who stayed on hardly criticized the program during the second year. On the one hand it naturally counts that the students with learning conceptions that did not fit in, dropped out; on the other hand it is also a matter of a learning effect at the delta-two level: as a result of the homogeneous team culture the students get into contact with one specific learning conception in an intensive way, which may be the cause of the above mentioned significant difference between the SI scores of first year and second year SOL students. This quantitative datum is supported by statements made by students in the interviews. We quote a second-year student as an example:
"What I found difficult to get used to when I went from my secondary school to this college was that you start to learn in an entirely different way. In the beginning, because it was quite new, you sometimes thought I wish we still did it as we did it in our secondary school; that is much safer. Whereas I now perceive that we work in an entirely different way. Much more practical. And then you say: this is nicer."
How do you learn now?
"Now you reflect on the way in which you learn and the way in which you have learnt something."
What extras are in it for you?
"I think that it is very important, because you can fall back on old things that you know already and use that as a basis for your present work."

From the point of view of reflective teaching as a fundamental training goal the essence of the training seems to be in this *development and shifting of learning conceptions*.

Conclusions

We may conclude that the teacher educators of the mathematical department of the SOL have a rather unanimous and explicitly described vision. Reflective teaching occupies a central position; structure, safety and challenge are considered to be important factors. In practice, however, didactic action of the educators is determined to a high degree by their perceptions of individual students and the repertoire of strategies the educators have at their disposal. In general they are doing well with active and reflective students who take the initiative. This is connected with the belief that prospective teachers should be growth-motivated and process-oriented. Other beliefs about learning are hardly recognized.

The belief systems of teacher educators and their subjective perceptions and theories have a great influence on the action in the supervision situation. If we schematize the learning processes in teacher education and their effects on the future teaching practice of the students as in figure 1, it will become clear that fundamental processes take place on the tangent plane between the belief systems of the teacher educators and those of the students and that this tangent plane should be the point of application for the development of teacher education. The results indicate for instance that the teacher educators in our study (probably on account of their pronounced vision of teacher education) give rise to significant developments in their students concerning learning orientations. We have to comment on that, however, that the quantitative data from the I.E.O.-test have been obtained via cross-sectional research (first year students compared with second year ones). The data have to be enlarged with information per student, obtained during longitudinal research. Part of the effects found may for instance also be explained by assuming that fewer reflective students disappear from the teachers' college via (self)selection (cf. the I.E.O.-scores of the drop-outs and those who stayed on). This is the other side of the picture: in this preparation program, based on reflective teaching, we are clearly dealing with a clash between the learning conceptions of the teacher educators and those of part of the students. This may lead to students dropping out or to simulated learning behavior (*quasi-adaptation* to

the learning conceptions of the educators). In order to optimalize the training didactics belonging to reflective teaching, it is therefore of fundamental importance that supervision strategies are gathered that take differences in learning conceptions into account, especially the differences described in the model of figure 2. Such a forming of didactic theories about teacher education in which the question of training didactics and preference of students for a certain way of learning takes up an explicit place, is still lacking almost completely. It will be the most important objective of our further research and of seminars with teacher educators organized by us. Our starting point in this is that research can only have the desired effect on practice if this research takes place in close cooperation with teacher educators.

[1] We express our thanks to Mr. M.D.G. Swaen's contributions to the development of the I.E.O.-questionnaire and to Mr. G.J. van de Brink for the statistical processing of the quantitative data.

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